National Institute of Environmental Health Sciences
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Superfund Research Program

The Superfund Research Program (SRP) supports practical research that creates benefits, such as lower environmental cleanup costs and reduced risk of exposure to hazardous substances, to improve human health. SRP funds colleges, universities, and small businesses, including the University of North Carolina at Chapel Hill Superfund Research Center (UNC SRC), to advance this work across the nation.

Research Highlights

Understanding genetic susceptibility to environmental chemicals

Researchers led by Ivan Rusyn, M.D., Ph.D., identified genetic differences that can influence an individual's susceptibility to the toxic effects of trichloroethylene (TCE).[1] TCE, a common groundwater contaminant, is linked to liver cancer and other health problems.[2] Rusyn's team compared different strains of mice, similar to a diverse group of people, to see whether they break down TCE differently. They reported that a specific metabolic break-down product, called trichloroacetic acid, was associated with liver enlargement and other liver effects. This result suggests that people who produce more trichloroacetic acid may be more susceptible to TCE's effects, and sheds light on how TCE may cause liver cancer. The information is also important for assessing potential health risks for people exposed to TCE.

Understanding arsenic health effects in newborns

Using a large-scale, state-of-the-art screening approach, Rebecca Fry, Ph.D., and her research team reported that changes in proteins in newborn umbilical cord blood were linked to the amount of arsenic in the mother's urine.[3] Arsenic exposure during development is associated with a wide range of health effects, including cancer, that can persist into adulthood.[4] Fry's team reported both increases and decreases in 111 different proteins in cord blood of newborns exposed to arsenic in the womb. Almost half of these proteins are involved in immune responses and inflammation. When researchers compared the results for boys and girls, they found that boy infants with increased protein had early indicators of possible neurological effects later in life. These results provide insight into arsenic effects in children, and why some people are more susceptible to arsenic than others.

Fry, second from right, and her team study arsenic exposure during development. (Photo courtesy of UNC SRC)

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Researchers at UNC SRC seek to understand the human health and environmental risks associated with exposure to the highest priority chemicals regulated under the Superfund program. Priority chemicals include polycyclic aromatic hydrocarbons (PAHs), halogenated hydrocarbons, and heavy metals. They also develop strategies to more efficiently clean up hazardous waste sites.

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Identifying contaminants at hazardous waste sites

Damian Shea, Ph.D., UNC SRC researcher and professor at North Carolina State University, has developed a new sampling device for detecting multiple chemicals in water, soil, and sediments, and measuring how much of those chemicals can be absorbed by living organisms.[5] The new device uses special plastics that act like sponges to soak up chemicals for later testing in the lab. The researchers have been using it to collect and test more than 200 top-priority chemicals at five Superfund sites in North Carolina and Virginia.[6]

The new sampling device developed by Shea's team helps researchers collect and transport samples more easily. (Photo courtesy of UNC SRC)

The importance of science-based risk assessment

- Risk assessment is the process used to identify the type and magnitude of health risks that exist in specific circumstances, such as near a Superfund site.[7]
- Government agencies, like the U.S. Environmental Protection Agency, use scientific data to make informed regulatory decisions about health risks.[8] UNC SRC research helps inform those decisions.

Research overview

- Identifying biological markers of exposure to specific chemicals, to strengthen the scientific basis for risk assessment. (James Swenberg, Ph.D., james_swenberg@unc.edu)
- Understanding genetic differences in liver and kidney cancer susceptibility, and risk assessment for TCE. (Ivan Rusyn, Ph.D., irusyn@cvm.tamu.edu)
- Applying new analytical tools to understand critical pathways for toxicity related to metals, such as cadmium and arsenic. (Rebecca Fry, Ph.D., rfry@email.unc.edu)
- Evaluating complex microbial communities in bioremediation systems to break down chemicals, in particular PAHs. (Michael Aitken, Ph.D., aitken@email.unc.edu)
- Quantifying chronic exposure and bioavailability of toxic compounds in environmental systems. (Damian Shea, Ph.D., d_shea@ncsu.edu)

Sharing results

The UNC SRC Research Translation Core focuses on communicating the center's research findings, enabling government officials and the public to make informed decisions about reducing risk. They are also responding to research and outreach needs identified by government agencies and local health departments in communities with hazardous waste sites. (Kathleen Gray, kgray@unc.edu)

Other contributions to advance science

- The UNC SRC research support facility provides vital access to expertise, research resources, and state-of-the-art instrumentation for its research projects. (Fred Wright, Ph.D., fred_wright@ncsu.edu; Avram Gold, Ph.D., avram_gold@unc.edu)

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For more information on the National Institute of Environmental Health Sciences, visit **www.niehs.nih.gov**.

For more information on the Superfund Research Program, visit **www.niehs.nih.gov/srp**.

For more information on the University of North Carolina at Chapel Hill, Superfund Research Center, visit **http://sph.unc.edu/srp**.

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